Demand Charge

WHO PAYS IT Larger commercial and industrial customers

PURPOSE User should pay the cost of equipment to serve the load.

BACKGROUND All electrical equipment must be sized to serve anticipated load. This can be done by using total connected load. In a home the total of the connected load (in this example the total of the circuit breakers is used which makes this example extremely simplified) would look like

HOME LOADS	CIRCUITS	VOLTS	AMPS	Kw
RANGE	1	240	60	14.4
ELECTRIC HEAT	3	240	60	14.4
HOT WATER	1	240	30	7.2
DRYER	1	240	30	7.2
RECEPTACLES	4	120	80	9.6
LIGHTS	4	120	80	9.6
TOTAL			340	62.4

The total connected load would overload a typical 200 amp service. Derating factors are used in calculating loads when designing household distribution. They take into account that not all loads are operated simultaneously. Few people operate all burners on a range at full power at once, not all baseboard heaters are on at the same time, for example which is why the service is able to safely handle the total connected load.

There are peak load times in households generally in the morning before leaving for work and return in the evening after work.

Industry has their peak loads also; they come to work turn on the lights, coffee makers, air compressors, office heaters, process heaters, computers, etc etc. As the shift proceeds these loads will turn off and on randomly and the overall load is decreased throughout the shift. The peak load is a much higher factor in industry than in residential especially so for utilities who must design the substations and distribution to handle the short term peak loads.

Utilities can collect the higher installation and maintenance cost of equipment to serve industrial customers either as part of the charge for power or as a separate charge termed demand charge.

Where the demand charge question becomes apparent is comparing different demands of different equipment. Three motors of different size are used for comparison, all are served by 3 phase 480 volt. A rule of thumb for starting current is 4 to 9 times the running current. In this case the ratio is assumed to be 5 for each motor. In the real world the 1,000 Kw motor would quite possibly be on a 4,160 or 12,500 volt line.

SIZE Kw	OPERATING HOURS	TOTAL POWER	AMPS RUNNING	AMPS STARTING	EQUIPMENT COST

MOTOR A	10	100	1000	12.0	60.2	$145.02
MOTOR B	100	10	1000	120.4	602.1	$2,900.38
MOTOR C	1000	1	1000	1,204.2	6,021.2	$58,007.66

- the power used for all three is the same (1,000 Kw Hrs),
- equipment in the case of motors is sized to supply the starting current.
- as can be seen in this example the starting currents vary, so will the equipment size.
- equipment cost is not directly proportional to size, in many cases cost rises geometrically with size as shown here (cost is arbitrarily chosen for example purposes only).
- It would not be fair to charge the same rate (power at 1000 Kw Hr) for all three when the equipment size and cost vary widely.

Only one major distribution center (substation) handles one customer. The rest must be designed to handle the total load of all customer loads each of which will be different due to the operating characteristics of their business. Each substation will have it's own unique loading which will cause it to have unique design, installation and maintenance costs.

Special meters are installed to measure this peak load using three 5 minute averages. These are added together and multiplied by four to yield an hourly value. The highest value is recorded and read for billing purposes. This reading is reset when the meter is read.

Reasons to collect using the power (Kw Hr)

- Simpler only one meter function is needed
- Easier for customers to understand
- Less accounting
- City Light generation can meet peak demand BUT the limiting factor is the reserve of water behind the dam
- Energy cost (Kw Hr) is set high to send a conservation message (ie keep more water behind the dam for future use)

Reasons to collect using demand charge

- Collects the cost of installed equipment
- More closely approximates the individual business share of equipment cost required to handle the load placed on the equipment by that business.
- More closely charges for the demands place on the system by operating characteristics unique to each business type
- More closely charges for the demands place on the system by operating characteristics unique to each business management style.

CURRENT CITY LIGHT DEMAND CHARGES

	NETWORK			NON NETWORK		
	PEAK PERIOD	NON PEAK PERIOD	FLAT RATE (no peak factor)	PEAK PERIOD	NON PEAK PERIOD	FLAT RATE (no peak factor)
MEDIUM DEMAND	N / A	N / A	$1.59	N / A	N / A	$1.03
LARGE DEMAND	$0.84	$0.17	N / A	$0.40	$0.17	N / A
HIGH DEMAND	(none in the Network)		N / A	$0.40	$0.17	N / A

- The value is obtained from three 5 minute averages which are added and multiplied by 4 to make it an hourly value
- Because of the increased reliability of the network Network charges are higher as result of higher equipment cost.
- Peak period is Monday thru Saturday 6 am to 10 pm
- The demand charge will detect and record motor starting. This effect is diminished because the very high current draw is of short duration (one to three seconds)
- Peak Demand Charges are set to recover transformer cost and one half the transformer losses
- Off Peak Demand Charges are set to recover the transformer investment discount rate WHAT IS THAT ?????
- Why such a higher rate for medium demand????
- Why no peak period metering for Medium Demand??
- is there any way to base the demand charge based on the cost of the individual substation ?? That way the demand charge would more closely match the costs of the sub.
- City Light gave no financial guidance – how do I estimate costs of substation equipment?
- How do I divide up customer fair share of substation costs?

EVALUATION OF FINANCIAL IMPACT OF THE DEMAND FACTOR

- Customer overall power consumption (Kw Hr) is kept constant
- Average hourly power use = Total Kw Hr divided by 30 days divided by 24 hrs per day.
- the average hourly power use Kw Hr per Hr (?) is kept constant

Three cases are evaluated where the demand factor

- is the same as the Kw Hr per Hr
- demand is threefold
- demand is ten fold

CUSTOMER WITH LOW POWER AND DEMAND EQUALS AVERAGE KW Hr

			NETWORK DEMAND CHARGES			NON NETWORK DEMAND CHARGES		
	AVG HRLY Kw Hr	PEAK DEMAND	PEAK PERIOD	NON PEAK PERIOD	FLAT RATE NO PEAK FACTOR	PEAK PERIOD	NON PEAK PERIOD	FLAT RATE NO PEAK FACTOR
MEDIUM DEMAND	52.78	52.78	N / A	N / A	$83.92	N / A	N / A	$54.36
LARGE DEMAND	52.78	52.78	$44.33	$8.97	N / A	$21.11	$8.97	N / A
HIGH DEMAND	52.78	52.78	(none in the Network)			$21.11	$8.97	

CUSTOMER WITH LOW POWER AND DEMAND IS 3 FOLD AVERAGE Kw Hr

			NETWORK DEMAND CHARGES			NON NETWORK DEMAND CHARGES		
	AVG HRLY Kw Hr	PEAK DEMAND	PEAK PERIOD	NON PEAK PERIOD	FLAT RATE NO PEAK FACTOR	PEAK PERIOD	NON PEAK PERIOD	FLAT RATE NO PEAK FACTOR
MEDIUM DEMAND	52.78	158.33	N / A	N / A	$251.75	N / A	N / A	$163.08
LARGE DEMAND	52.78	158.33	$133.00	$26.92	N / A	$63.33	$26.92	N / A
HIGH DEMAND	52.78	158.33	(none in the Network)			$63.33	$26.92	

CUSTOMER WITH LOW POWER AND DEMAND IS 10 FOLD AVERAGE Kw Hr

			NETWORK DEMAND CHARGES			NON NETWORK DEMAND CHARGES		

	AVG HRLY Kw Hr	PEAK DEMAND	PEAK PERIOD	NON PEAK PERIOD	FLAT RATE NO PEAK FACTOR	PEAK PERIOD	NON PEAK PERIOD	FLAT RATE NO PEAK FACTOR
MEDIUM DEMAND	52.78	527.78	N / A	N / A	$839.17	N / A	N / A	$543.61
LARGE DEMAND	52.78	527.78	$443.33	$89.72	N / A	$211.11	$89.72	N / A
HIGH DEMAND	52.78	527.78	(none in the Network)			$211.11	$89.72	

ESTIMATION OF IMPACT ON ACTUAL CUSTOMERS

The effect of demand charge is evaluated where customers are at the bottom of their consumption bracket and at the top of the bracket. The brackets are defined by City Light as

Medium General Service bracket is greater than 50 and less than 1,000 Kw Hr
Large General Service bracket is greater than 1,000 and less than 10,000 Kw Hr
High Demand Service bracket is greater than 50 and less than 10,000 Kw Hr

CUSTOMERS AT THE BOTTOM OF THEIR BRACKET AND DEMAND EQUALS AVERAGE KW Hr

			NETWORK DEMAND CHARGES			NON NETWORK DEMAND CHARGES		
	AVG HRLY Kw Hr	ONE HOUR PEAK DEMAND	PEAK PERIOD	NON PEAK PERIOD	FLAT RATE NO PEAK FACTOR	PEAK PERIOD	NON PEAK PERIOD	FLAT RATE NO PEAK FACTOR
MEDIUM DEMAND	50	50	N / A	N / A	$79.50	N / A	N / A	$51.50
LARGE DEMAND	1,000	1,000	$840	$170	N / A	$400	$170	N / A
HIGH DEMAND	10,000	10,000	(none in the Network)			$4,000	$1,700	

CUSTOMERS AT THE TOP OF THEIR BRACKET AND DEMAND EQUALS AVERAGE KW Hr

			NETWORK DEMAND CHARGES			NON NETWORK DEMAND CHARGES		
	AVG HRLY Kw Hr	ONE HOUR PEAK DEMAND	PEAK PERIOD	NON PEAK PERIOD	FLAT RATE NO PEAK FACTOR	PEAK PERIOD	NON PEAK PERIOD	FLAT RATE NO PEAK FACTOR
MEDIUM DEMAND	1,000	1,000	N / A	N / A	$1,590	N / A	N / A	$1,030
LARGE DEMAND	10,000	10,000	$8,400	$1,700	N / A	$4,000	$1,700	N / A
HIGH DEMAND	million	1,000,000	(none in the Network)			$400,000	$170,000	

PROPOSAL FOR INCENTIVE TO REDUCE DEMAND CHARGE OR TO SHIFT LOAD

DEMAND THIS MONTH LAST YEAR	DEMAND THIS MONTH	DIFFERENCE	PERCENTILE DIFFERENCE	DEMAND CHARGE REDUCTION
100	79	21	21.00%	21.00%

REASONS TO LEAVE DEMAND CHARGES ALONE

REASONS TO INCREASE DEMAND CHARGE

- Incentive for customers to reduce “short term” high demand load which will reduce substation and distribution wire size to meet demands of short term high demand load
- let the power charge (Kw Hr) carry the conservation message

Recommendations

- Install time of use metering for Medium Service customers
- Adjust Medium Service demand charges to more closely match others
- Peak period extending from 6 am to 10 pm Monday thru Saturday seems excessive. Measure and reevaluate Peak Period based on metering (ideally for each substation)
- Evaluate feasibility of basing demand factor for each substation customer is served by
- Increase Peak Period demand charges to encourage customers to shift load to non Peak Periods.
- Pay customer for load shifting to non Peak Periods.